LOSG Key Findings 4/20/2017

Legend
Deleted words/paragraphs are shown as ~~Strikethrough~~
New words/paragraphs are in **RED**

Glossary of Acronyms and Definitions
9 Key Elements: Framework (and planning approach) for improving water quality in a geographic watershed by assess the contributing causes and sources of nonpoint pollution, involvement of key stakeholders, and prioritization of restoration and protection strategies. (http://dnr.wi.gov/topic/nonpoint/9keyelementplans.html)

Anaerobic - Pertaining to the absence of oxygen. An anaerobic digester uses biological processes in which microorganisms break down biodegradable material in the absence of oxygen.

ARB – Antimicrobial-Resistant Bacteria

AU - Animal Units

BMP - Best management practices

CAFO - Concentrated Animal Feed Operations

DATCP - Department of Agriculture, Trade, and Consumer Protection

Digester - A container that promotes decomposition or extraction of components usually into another substance through the use of heat, enzymes, or a solvent.

Freeboard - The required excess vertical storage capacity, as a safety precaution, to prevent manure storage overflow in the event of a major storm event.

IOH - Implements of Husbandry: Provides farmers with the ability to operate farm equipment legally on Wisconsin roads using defined vehicle standards.

LCD - Land and Water Conservation Division

Leachate – A solution or liquid that drains or leaches from a source, such as a landfill, manure, soil, etc., typically as a result of water percolating through a permeable material.

LOSG – Livestock Operation Study Group

LWRM Plan - Land Water Resource Management Plan

Mesophilic – Pertaining to microorganisms that grow best in moderate temperatures. A mesophilic digester uses a type of anaerobic digestion that takes place optimally around 86 to 100 ° F, or at ambient temperatures between 68 and 113 ° F, where mesophilic organisms are the primary microorganism present.

NMP - Nutrient Management Plan

NRCS - Natural Resources Conservation Service

PCB - Polychlorinated biphenyl

Peak Flow - The maximum velocity or rate of discharge during the period of runoff caused by a storm

is called a “peak flow”.

Thermophilic - Pertaining to microorganisms that grow best in high temperatures. A thermophilic digester uses a type of anaerobic digestion that takes place optimally around 120 to 140 ° F, where thermophilic organisms are the primary microorganism present.

TIA - Transportation Impact Analysis

TMDL - Total Maximum Daily Load

UW-EXT – University of Wisconsin-Extension

WCWRPC - West Central Wisconsin Regional Planning Commission

Zoonotic Disease – A disease that can be transmitted from animals to humans.

GENERAL Findings

1. **Agriculture is important to the economy and rural fabric of Dunn County. It is Dunn County’s responsibility to protect and balance the agricultural industry with the health, safety, and general welfare of the entire Dunn County community.**
2. **The sizes and types of farms and livestock operations in Dunn County are changing and the number of CAFOs in Wisconsin are increasing.** (WCWRPC Dunn Co Agricultural data)
   - From 1997 to 2012 in Dunn County (U.S. Census of Agriculture)
     - The number of medium size farms between 180 acres and 999 acres decreased by 218 farms (or -34.3%), while the number of large farms over 1,000 acres increased by 31 (or +77.5%). The number of small farms with less than 180 acres increased by 137 (or +146%).
     - All farms with cattle and calves (dairy, beef or other cattle) decreased from 817 farms in 1997 to 660 farms in 2012. The number of total cattle decreased by 6,221 head. Average cattle herd size increased from 84.7 to 95.5 head per farm.
     - The number of farms with 500 or more head of cattle grew from 7 farms to 27 farms. The total cattle herd size of these larger farms increased from 4,493 head in 1997 to 23,466 head in 2012.
     - The number of farms with 50 to 499 head of cattle decreased from 465 farms to 233 farms. The total cattle herd size on these medium-sized farms decreased from 56,507 head in 1997 to 32,492 head in 2012.
     - The number of beef cows changed little from 5,754 in 1997 to 5,776 in 2012,

though the number of farms with beef cows increased from 314 to 356.

- The number of milk cows decreased from 26,511 to 21,222, with a dramatic decrease in the number of farms with milk cows from 478 in 1997 to 199 in 2012.
- Farms with poultry increased from 74 in 1997 to 152 in 2012. Nearly 87% of farms with poultry in 2012 were layer chicken farms, with 4,328 layers in the County.
- Some specialty crop and livestock farming is increasing. For example, the number of milk goat farms increased from 3 in 1997 to 15 in 2012.

➢ Managed grazing is growing as a livestock and land management strategy.

- **"Many Dunn county farmers are adopting innovative conservation farming practices in both livestock and crop production. including: organizing one of the state's first farmer-led watershed projects, establishing a demonstration farm to evaluate conservation practices. and increasing cover crop use to over (?) acres. Ambitious goals for reducing environmental impacts from farming have been included in the Red Cedar Basin TMDL plan.**
- **There is growing interest in utilizing managed grazing systems in dairy and livestock production, and a recognition that these systems can provide a conservation-focused path for supporting an efficient and profitable dairy and livestock sector."**

➢ The number of CAFOs with WPDES permits in Wisconsin have increased from 87 in 2000 to over 300 in 2017; the WDNR has recently been receiving about 15 permit applications each year.

3. **CAFOs, given their larger size, pose a unique set of risks and the potential for greater negative impacts if something goes wrong due to the large concentrated amounts of manure. However, larger farms often have more resources and opportunities to implement mitigation and management practices to reduce these risks.**

4. **Non-CAFOs are regulated differently than CAFOs.**
   - ➢ In terms of reducing water quality risks from manure, the practices (e.g., facility design & maintenance, the manner, timing, & location of landspreading) are frequently more important than the size of the livestock operation. A smaller operation that is poorly managed can have greater negative impacts than a well-operated CAFO.
   - ➢ WDNR visits CAFOs a minimum of twice over a five-year permit cycle. A Summer 2016 audit of WPDES permit management and enforcement was highly critical of WDNR management of the WPDES program. It is important to continue monitoring whether recent WDNR staff reorganization for WPDES permitting will sufficiently address the audit concerns. (WDNR; Legislative Audit Bureau audit report)
   - ➢ CAFOs self-report to WDNR for WPDES permitting. Soil sampling is required every

three years and WPDES permits must be renewed every five years.

5. **Counties cannot adopt livestock siting standards that exceed state water quality standards without WDNR or DATCP approval.** (DATCP Options PDF)

6. **State permitting is "one size fits all." State policies often do not account for local variations in soil conditions, geology, subshed characteristics, etc. Regulatory setbacks from wells are largely arbitrary.** (Masarik, UW-Stevens Point; Bayfield County)

7. **Other Wisconsin counties (e.g., Bayfield, Kewaunee) have adopted livestock operations (not siting) and groundwater protection ordinances under State public health and "police power" authority. County zoning ordinances can also be used to guide the locating of new livestock facilities, though there are limitations of such an approach. As part of local facility siting review, some counties have also adopted more stringent standards based on reasonable, scientifically defensible findings of fact due to a public health or safety risk. (**WCWRPC compliance and case law summary; Davina Bonness; Fischback)
   - ➢ A Livestock Siting Ordinance adopted under County zoning is enforced in only zoned Towns whereas a Livestock Licensing Ordinance would be enforced County-wide. (Chris Clayton)
   - ➢ Seven of 22 Dunn County towns are currently unzoned.

8. **Dunn County Land Use Control and Land and Water Conservation Departments do not have Citation Authority (authority to issue citation when enforcing County ordinances/policies)** (Dan Prestebak)
   - ➢ Dunn County could adopt and enforce citation authority.

9. **The scope of the May 2017 Livestock Operation Study Group report looked at livestock operations of various sizes (not just CAFOs) and types (not just dairy).**

10. **It is very important that farmer are engaged and actively included as part of the solution when addressing agricultural concerns.**

11. **More public education on CAFO permit rules and potential risks are needed.**
    - ➢ Under Wisconsin's Right-to-Farm Law, a CAFO or other agricultural use is not a nuisance if the use began before the plaintiff "came to the nuisance" and the use does not present a substantial threat to public health or safety. This law does not distinguish between the types, size, or intensity of agricultural uses. Unless it presents a substantial health or safety threat, an existing livestock facility that wants to expand would not be a nuisance, since it was a pre-existing agricultural use. (Wis. Stats. 823.08; WCWRPC compliance and case law summary)

12. **Not all sites and locations in Dunn County are appropriate for a CAFO due to risk factors, local infrastructure, and/or potential land use conflicts. During the 2017 LOSG presentations, various risk factors and considerations were identified that may need to be addressed during planning and permitting decisions, including, but not**

limited to:

- ➢ localized soils, geology, depth to groundwater, and groundwater contamination susceptibility;
- ➢ proximity to wells and sources of drinking water;
- ➢ proximity to surface waters, shorelands, wetlands, outstanding natural resources, and environmentally sensitive areas;
- ➢ availability of appropriate land for acceptable nutrient management practices, including storage and landspreading ;
- ➢ the design, capacity, and safe use of roads and highways;
- ➢ proximity to existing or planned residential or urban transitional areas; and
- ➢ the potential to mitigate or prevent possible land use conflicts through comprehensive planning, zoning, setbacks, or voluntary management practices.

13. **The public needs to increase their knowledge of how livestock farms operate and how to get more information on farming in Dunn County.**

GROUNDWATER & SURFACE WATER

SURFACE WATER

1. **Soil erosion, nutrient runoff, peak flows, and groundwater deliver phosphorus to downstream waters. Too much phosphorus causes algae growth. Too much algae causes fish kills, makes water dangerous to humans and animals to swim in and drink, and impacts property values and the local economy.** (Bayfield Co., Dan Zerr)
   a. Barnyards, feedlots, and dry lots with unmitigated runoff to surface waters pose a threat to water quality and public health. (Bayfield Co.)
   b. Dunn County does not have a Stormwater/Erosion Control Ordinance. (Dan Prestebak)
   c. The State has a Stormwater Discharge Permit for construction sites over 1 acres in size.
   d. Peak flows containing sediments and dissolved phosphorus are the primary sources of phosphorus and algal blooms to surface water. (Zerr)
   e. Groundwater is a secondary source of phosphorus contribution to surface water. (Zerr)
   f. Certain agricultural practices such as cover crops ~~have~~ , no-till, and NMP can have a positive effect on soil health and surface water quality. (Masarik)

2. ~~**Phosphorus and sedimentation from agricultural runoff are contributing to impaired surface waters in Dunn County. (Dan Zerr)**~~ **The number of impaired waters in Dunn County has been increasing. (Dan Zerr)(LWRM Plan - LCD) ------> (DAN quantify)**
   a. ~~The number of impaired waters in Dunn County has been increasing. (Dan Zerr)(LWRM Plan - LCD)~~ Phosphorus and sedimentation from agricultural runoff are contributing to impaired surface waters in Dunn County. (Dan Zerr)
   b. There is evidence that water quality is cleaner at headwaters of streams. (Dan)
   c. Waters can be impaired for various reasons (for example PCB's in the Chippewa River).

(Zerr)

3. **Nitrate levels in the Red Cedar River have been increasing from agricultural runoff and groundwater sources. (Dan Zerr)**
    a. Increasing nitrate levels in surface waters may be primarily due to increased row crops production and human ~~modifications,~~ changes to the landscape along with livestock or manure management practices. (Dan Zerr)
    b. Best management practices are improving on applications of fertilizers such as split application and season long applications. (Masarki, Zerr)

GROUNDWATER

4. **Nitrates and ~~coliform~~ bacteria are the top groundwater contamination risks from manure. Statewide 9% of the wells tested exceeded the 10 ppm nitrate safe drinking water standard. Nitrate levels in Dunn County wells have been increasing, approximately half of the wells tested in the Towns exceed the state average. (Masarik, UW-Stevens Point; Dunn County Public Health Department)**
    a. High nitrates in drinking water can result in blue baby syndrome~~, etc.…~~ and the potential of higher risk of carcinogenicity (agent that can produce cancer) from nitrites in combination with amines and amides. (“~~How~~ Can Nitrate and Nitrite Affect My Health?” article)
    b. Bacteria from are ~~is~~ a public health concern due to manure, septic systems, and well conditions. (Bergeson)
    c. Rising nitrate levels in groundwater is not solely due to livestock facilities or the land application of manure. Increases in row crops, other types of fertilizers, and other land use changes are also contributing factors, though there is insufficient data to estimate the percentage differences between sources.(Masarik)
    d. Even with existing rules, nutrient management, and best practices, contamination of groundwater can still occur. (Masarik, UW-Stevens Point, Bonness, Kewaunee Co LCD)
    e. Old wells that are not properly abandoned or those with insufficient casing can be significant contributors to groundwater pollution.
    f. There are gaps in groundwater monitoring, testing, and tracking.
    g. Groundwater phosphorus is often overlooked and less data is available. (Masarik, UW-Stevens Point)
    h. Corn ~~only~~ uses 37% of the nitrogen that is applied (manure or fertilizer). (Masarik)
    i. Humans receive the nitrates they need from multiple sources (water, food, veggies, and processed meats). (put data with this)
5. **The leaching of nitrates from fertilizer and manure in the sandy soils of many areas of Dunn County pose a higher risk of groundwater contamination.**
    a. Sandy soils have high infiltration **rates**. (Masarik)
    b. Well data reports for Dunn County ~~have~~ shown ~~n~~ a correlation between high nitrates and sandier soils.
    c. Row Crops (corn and potatoes) have shown to contribute to nitrates more so than forages. (Masarik)
    d. Best management practices are improving on applications of fertilizers such as split application and season long applications. (Masarki, Zerr)

6. **Water related data is maintained by a variety of Departments and stakeholders.**
    a. Some of the well data is old/outdated (Keith Bergeson, Dunn County Health)
    b. Dunn County is pursuing increased testing and correlating data.
    c. Dunn County has capabilities to track groundwater data. (Keith)

7. **Well test results from private testing labs ~~is~~ are not always shared with the Health Department. (Keith Bergeson, Dunn County Health)**

8. **Groundwater baseline testing is important to the management of groundwater quality. (Davina Bonness)**

MANURE MANAGEMENT & NMP

9. **CAFOs are considered point sources and no discharges including leachate are allowed from the livestock facility. (Dan Prestebak)**
    a. Leachate systems for Non-CAFOs cannot be required without cost sharing (Dan Prestebak)
    b. There is a potential conflict with state law in regards to livestock siting as to the definition of leachate. (Dan will look into this more)
    c. ~~In livestock siting, leachate is defined as feeds with more than 70% moisture. (potential conflict with state law). (Dan Prestebak)~~

10. **Handling of manure (storage and spreading) is a ~~threat~~ potential risk to water quality. (Kevin Masarik)**
    a. NRCS 313 and 634 contain standards for manure storage and waste transfer

11. **To obtain a WPDES permit for a manure storage structure, CAFOs are required to meet specific requirements. (DAN) ~~If a storm event exceeds the holding capacity of a manure storage pit, excess stormwater is allowed to be discharged over land.~~**
    a. Manure pits for CAFO's are designed with a minimum of 180-day storage capacity
    b. Manure pits are designed with additional storage capacity to hold a 25-year storm event, ~~however, the frequency of storms are increasing~~. and with 1 foot of additional storage (freeboard). (Dan, Chris)
    c. ~~Manure pits (CAFO) are designed with an additional foot of storage (freeboard)~~
    d. Overflowing pits (CAFO) are reported to the State
    e. The frequency and severity of storms are increasing. (Source needed)
    f. If a storm event exceeds the holding capacity of a manure storage pit, excess stormwater is allowed to be discharged over land. (Source)
    g. ~~Dunn County does not have a Stormwater / Erosion Control Ordinance (Dan Prestebak~~)

12. **The creation, implementation, and compliance with Nutrient Management Plans (NMPs) are very important to protecting surface water and groundwater quality, especially from nitrates, phosphorus, and bacteria. (Dan Prestebak)**
    a. Only 9% of Dunn County's cropland acres have NMP. (DATCP, Wisconsin Nutrient Management Update, 11/16)
    b. NMP Participation is much higher in Farmland Preservation Program districts. (Dan Prestebak)
    c. Cropland that receives commercial fertilizer, manure, or other nutrients are required by State Statutes NR 151 to have a NMP, regardless of the type of farm operation. (NR 151)

d. While all farmers that apply nutrients must have a NMP by State law, counties cannot require nutrient management planning (or prescribe specific, related practices) unless the county provides cost-sharing or if the operation: (i) is causing a significant discharge, (ii) is regulated by a local manure storage ordinance, a livestock siting ordinance, or by a WPDES permit, (iii) accepting manure storage cost share funds, or (iv) participating in a farmland preservation program. (DATCP, Wisconsin Nutrient Management Update, 11/16)

e. ~~CAFOs self report. (Dave Styers)~~
f. The NMP standards do not differentiate between nutrients in manure vs commercial fertilizers. (NRCS 590)
g. ~~Cropland that receive commercial fertilizer or manure are required by State Statutes NR 151 to have a NMP, regardless of the type of farm operation (NR 151)~~

OTHER WATER-RELATED

13. **More research is needed to better determine the sources of nitrate and phosphorus loading into Dunn County groundwater and surface waters.**
    a. It is not currently possible to accurately estimate pollutant loading by source, including the nitrate, phosphorus, or bacteria pollutant contributions from livestock operations of various sizes in Dunn County. (Zerr)
    b. More data needs to be collected from the source of bacteria in water to livestock and humans.
14. **Soil health practices is imperative to protecting both surface and groundwater.**
15. **Farmer education and farmer-led initiatives are critical to improving Dunn County's water, soil health and conservation (Dave Styers)**
    a. ~~The public needs a greater understanding of how farms operate. (key finding or sub-finding)~~

TRANSPORTATION

1. **Heavy trucks associated with livestock operations for the movement of livestock, dairy products, manure, and other goods and services can damage roadways and shoulders and increase traffic safety risks.** (Jesse Rintala, Dunn County Highway)

    a. County and Town roads are not constructed to the same standards.
    b. ~~All agricultural sectors has experienced an increase in traffic volumes.~~
    c. IOH laws allow ~~usage~~ permitting of heavy farm equipment/vehicles on roads in certain circumstances. (See source "The IOH Law" and "Implements of Husbandry")
    d. Modern agricultural farming equipment/vehicles and large farm operation can decrease road longevity by more than 50% (April 2017 Wisconsin Town Association - Sustainable Transportation Solution)

2. **Dunn County Highway Department conducts Traffic Impact Analysis (TIA) for non-metallic mines to determine potential impacts from proposed traffic generators, but a similar procedure for CAFOs and large livestock operations does not exist. (Jesse Rintala, Dunn County Highway)**

    a. TIA analysis is usually limited to County Roads (Jesse Rintala, Dunn County Highway)
    b. Agreements/contracts usually are between the traffic generator and the ~~County~~

jurisdiction responsible for the road. (Jesse Rintala, Dunn County Highway)

c. TIA can be conducted at local and county levels.
d. ~~Funding for road maintenance is declining.~~ Construction and maintenance cost out pace funding.
e. Ag. vehicles are exempt from the fuel tax

3. **Weight & speed restrictions can be placed on Town and County roads year round. (Jesse Rintala, Dunn County Highway)**
    a. A written policy does not exist regarding exceptions to the road ban at the Town and County level. (Jesse Rintala, Dunn County Highway)

4. **Draglines can be an efficient method to spread liquid manure with less heavy equipment trips on Roadways.** (Bazooka Farmstar)

    a. County/Town policies do not exist to allow draglines to be in the County ROW or to cross under County roads through a culvert. (Jesse Rintala, Dunn County Highway)
    b. Currently there is no data on manure spill risk between a manure dragline vs hauling.
    c. No policy is in place for draglines near or crossing navigable waterways at this time.

    d. Proactive with draglines

5. **Manure is transported across jurisdictional lines.**

AIR and ODOR QUALITY

1. **Concentrated livestock operations can emit hazardous chemicals and particulates including ammonia, hydrogen sulfide, and dust in quantities larger than smaller livestock operations.**
    a. Increased exposure to air pollution from livestock operations can cause or exacerbate respiratory conditions (asthma, eye irritation, difficulty breathing, wheezing, sore throat, chest tightness, nausea, and bronchitis and allergic reactions) (John Hopkins - Public health).
    b. Of the 25 known toxic air pollutants, two are likely emitted from agricultural waste above levels of concern. These pollutants are ammonia (NH3) and hydrogen sulfide (H2S). The U.S. EPA has determined that simultaneous exposure of the two substances (both pulmonary irritants) results in an additive effect. (WDNR Agricultural Waste Air Emissions Advisory Group and Iowa CAFO Air Quality Study)
    c. ~~The WDNR in 2010 convened the Agricultural Waste Air Emissions Advisory Group to develop BMPs for reduction of hazardous air pollutants (primarily ammonia and hydrogen sulfide) from livestock operations. (WDNR Agricultural Waste Air Emissions Advisory Group)~~
    d. ~~In general, practices which reduce odor tend to reduce ammonia and/or hydrogen sulfide, but not always. (WDNR Agricultural Waste Air Emissions Advisory Group)~~
    e. ~~While certain practices may be effective for controlling emissions from one part of a farm, it is important to understand how emissions are controlled at other parts (WDNR AG Waste Air Emission Advisory Group)~~
    f. Even when using beneficial management systems and mitigation techniques, some airborne contaminants may be generated. Most concerns are associated with chronic or long-term exposure. However, some human and animal health concerns or safety hazards can result from acute or short-term exposures. (WDNR Agricultural Waste Air Emissions Advisory Group)

g. There is an extensive literature documenting acute and chronic respiratory diseases and dysfunction among workers, especially swine and poultry workers, from exposures to complex mixtures of particulates, gases and vapors within CAFO units. (Iowa CAFO Air Quality Study)

2. **CAFOs (Livestock operations) can negatively affect air quality through emissions from land spreading, storage, and drift from manure applications.**
   a. Monitoring air quality is difficult, Bayfield County did not act on this, they decided to wait for Federal and State standards
   b. Odor Management (CAFOs) scoring is required as part of Livestock Siting for farms with 500 or more Animal Units. However, there are several exceptions to this. ATCP 51 provides exemptions to odor standard for an expansion of fewer than 1000 AU, a new facility with fewer than 500 AU, and all livestock structures associated with a facility located at least 2500 feet from nearest neighbor.
   c. Once an odor standard has been scored, it applies to that operation even if it changes in size.
3. **Monitoring air quality ~~is difficult~~ and odor is difficult and costly.** (Iowa CAFO Air Quality Study)
   a. Bayfield County limited their study recommendations regarding odor to best management practices and education; they decided to wait for Federal and State standards instead of regulating locally.
   b. There is limited research about how odor and air quality overlap and impact those who live near CAFOs.
   c. Health complaints from neighboring residents are similar to problems of those directly exposed to ammonia and hydrogen sulfide. (Iowa CAFO Air Quality Study)
4. **Different animal type-CAFOs present different air and odor quality challenges**
   a. Different production methods, animal types, and manure management systems have the potential to create different types and quantities of air emissions. (WDNR Agricultural Waste Air Emissions Advisory Group)
5. **There are BMP and alternative strategies to can mitigate air and odor quality.**
   a. The WDNR in 2010 convened the Agricultural Waste Air Emissions Advisory Group to develop BMPs for reduction of hazardous air pollutants (primarily ammonia and hydrogen sulfide) from livestock operations. (WDNR Agricultural Waste Air Emissions Advisory Group)
   b. In general, practices which reduce odor tend to reduce ammonia and/or hydrogen sulfide, but not always. (WDNR Agricultural Waste Air Emissions Advisory Group)
   c. While certain practices may be effective for controlling emissions from one part of a farm, it is important to understand how emissions are controlled at other parts (WDNR AG Waste Air Emission Advisory Group)

PUBLIC HEALTH

Diseases, pathogens, and pollutants that are detrimental to public health can be transmitted or spread in a variety of ways. The Other Public Health Findings in this section focus on health findings and potential impacts that are not solely water- or air-related. Public health findings specific to water (e.g., nitrates in drinking water, nutrient runoff) are largely addressed in the Groundwater & Surface Water Findings. Public health findings specific to air quality are largely addressed in the Odor & Air Quality

Findings.

1. **Disease organisms, in manure pose a threat to public health.** (Rob Thiboldeaux)

    a. In general, manure is not routinely tested for pathogens. While manure spreading on fields is not tested at all. (Lee Jensen)
    b. The chemical makeup and biological activity in stored manure changes when it is applied to the land. (Borchardt Studies and WI Manure Irrigation Workgroup)
    c. Types of pathogens and their concentrations in the field run off are highly variable. Runoff may contain pathogens many months after manure application. The problem is if the manure has high pathogen concentration to begin with, even despite a 99.9% reduction, the concentration in runoff can remain above the dose that will cause infections. (Mark Borchardt, USDA)
    d. Livestock manure generally contains three types of zoonotic disease organisms: bacteria (campylobacter, salmonella, E.coli), protozoa (cryptosporidium, giardia), and viruses (rotavirus, enterovirus, hepatitis E) (Bayfield CAFO Study)
    e. ~~Vectors for spread of antimicrobial resistant bacteria in poultry feeding operations to the community~~ There are multiple ways for ARB to be spread in the community in poultry feeding operations. These can vary from poultry workers carrying higher loads of E.coli to flies and poultry litter carrying ARB from poultry barns. (Environmental Health Perspectives Journal, Science of the Total Environment Journal, and Environmental Research Journal)
    f. ~~Decisions about the amount of safe setback from manure irrigation in part depends upon the measure of risk one wants to assume~~ Manure applications and irrigation presents different risks one chooses to take on. Borchardt's study using current 500 foot setback showed median risk of illness can vary downwind from 1 in 100 to 1 in 100,000 on one exposure. If use a higher standard than median, risk can increase, also risk can increase with multiple exposures. (Mark Borchardt)
    g. Pathogen concentrations in air downwind from manure irrigation depend primarily on wind speed, initial pathogen concentration in manure and distance. Results show microbial concentrations decline with distance but still detectable at 700 feet downwind depending on wind velocity and microbe concentration in manure. (Mark Borchardt)
    h. Risk reduction depends on BMPs at each point of collection, processing/treatment, storage, transfer and land application. (Report from the Wisconsin Manure Irrigation Work Group)
    i. Research with mesophilic anaerobic digesters ~~(all mesophilic - 5 plugflow & 2 continually mixed)~~ show reduced pathogen concentration, although pathogen removal was highly variable ~~by date. Removal efficiency for all decreased in summer~~. Pathogen removal in this study was too variable to assume mesophilic digestion always results in significantly reduced infection risks. (Mark Borchardt)
    j. The LOSG did not have sufficient time to study thermophilic anaerobic digesters.
    k. Algal bloom toxins can adversely affect human and animal health through exposure to contaminated recreational and drinking water. (Scientific World Journal)

2. **The LOSG did not have the time to study ~~the impacts on~~ public health impacts of estrogenic compounds, antibiotics, and other component of manure migrating to**

groundwater and surface waters. ~~are unknown; needs additional study~~.